

CHAPTER 4

SHIP'S INPUT SYSTEMS

A ship's input system is defined as a system that provides an essential input to an equipment or another system and is maintained by the Electronics Technicians (ETs). These input systems receive data from equipment generally maintained by another department, such as engineering. The data is distributed throughout the ship to other users as well as engineering. Many of these systems are on board Navy ships.

In this chapter, we will discuss the basic gyrocompass system and the basic underwater log system. Because these two systems are the sole responsibility of the engineering department and unauthorized personnel are not permitted access to them, no attempt will be made to teach the maintenance of these systems. Only a brief description of the overall system will be provided. This knowledge will assist you with a better understanding of the ship's input to your equipments and systems especially during troubleshooting.

GYROCOMPASS SYSTEMS

The gyrocompass provides a means of determining ownship's heading, roll, and pitch of the ship. Gyrocompass systems include the Mk 19, Mk 23, Mk 27, and AN/WSN-2. The gyrocompass system transmits information to weapons control, sonar, radar, degaussing, depth control, dead reckoning and other equipment or systems as required. Components of the gyrocompass system include: gyrocompass control Cabinets, power supply, indicators for ship's heading, roll, and pitch (analog and digital), synchro signal amplifiers, and synchro signal converters. Normally the Interior Communications Technician (IC) and Electrician's Mate (EM) will maintain this equipment.

Gyrocompasses are identified by the mark (Mk) modification (Mod) system. The Mk number designates a major development of a compass. The Mod number indicates a change to the major development. Two new gyrocompass systems are currently being installed on Navy ships. These are the stabilized Gyrocompass Set AN/WSN-2 and the Inertial Navigation Set AN/WSN-5. We will briefly discuss both in this chapter.

MK 19 GYROCOMPASS

The Mk 19 gyrocompass seeks and continuously indicates the degree of the ship's roll, pitch, and heading. The Mk 19 gyrocompass furnishes precise synchro roll, pitch, and heading data for use in navigation equipments. It also is used in stabilizing surveillance, sub-surface search (sonar), surface search, air search, navigation, and fire control radar systems. The Mk 19 gyrocompass consists of four major components: master compass, control cabinet, failure annunciator, and power supply as shown in figure 4-1. The Mk 19 gyrocompass system is installed aboard warships (submarines, DD types, and larger), amphibious warships (LSDs and larger), auxiliary ships (longer than 91 meters (300 feet), patrol ships (FF types and larger), and mine warfare ships.

Output Signals

These Mk 19 gyrocompass provides the following output signals: heading (1X, 36X synchro), roll and pitch (2X, 36X synchro). The heading data is provided on two different buses: normal and critical. To prevent overload of the static power supply when operating on battery power, the normal bus is disconnected and only those indicators on the critical bus remain operational.

Heading Indicators

Heading indicators display ownship's heading information received from the ship's gyrocompass system. The indicators may be either synchro-servo or digital indicators. The indicator may be single (1X) or combined single and thirty-six (1X, 36X) speeds. Thirty-six speed indicators are used for precise readings. Digital indicators provide a three-digit, solid-state, readout of ship's heading with a range of 000 to 359 degrees in one-degree increments.

Single and thirty-six (1X, 36X) speed indicators are provided in areas such as:

- AFT Steering—each trickwheel and emergency steering
- Pilot House—ship control console, OOD steering, and bridge wings (pelorus)

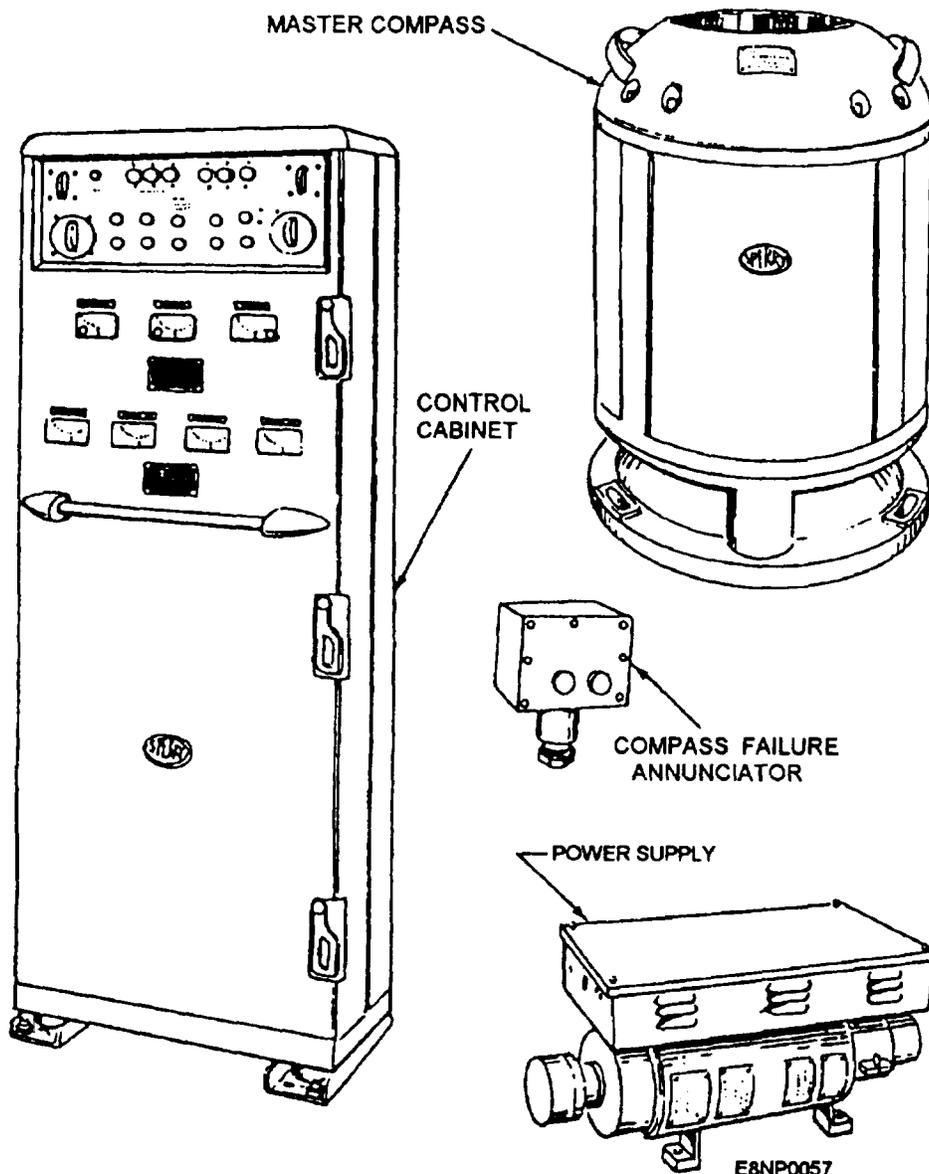


Figure 4-1.—Mk 19 Mod 3A gyrocompass equipment.

- Gyro mom
- Ship control station-outboard and inboard positions

Single (1X) speed indicators are provided in areas such as:

- Pilot house-chart table, CO's chair
- CIC—command table, surface ops, and sub-surface ops
- Sonar control
- Air ops
- Tactical air control

Mk 23 GYROCOMPASS SYSTEM

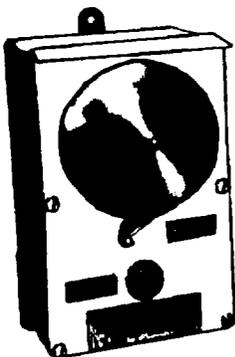
The Mk 23 gyrocompass system seeks and continuously indicates bearing or true north. The Mk 23 gyrocompass is capable of withstanding severe operating conditions in small boats, amphibious vehicles, surface vessels, and submarines. The Mk 23 gyrocompass consists of six major units the master unit, the control cabinet, alarm bell, compass failure annunciator, alarm control, and speed unit (depicted in figure 4-2).

Output Signals

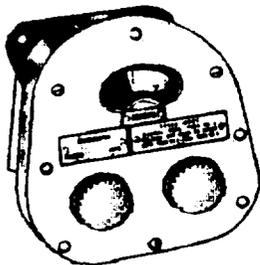
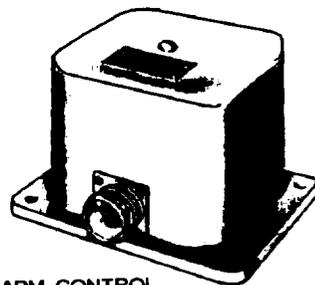
The Mk 23 gyrocompass provides 1X and 36X synchro data and heading to external equipments and systems.

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ALARM BELL



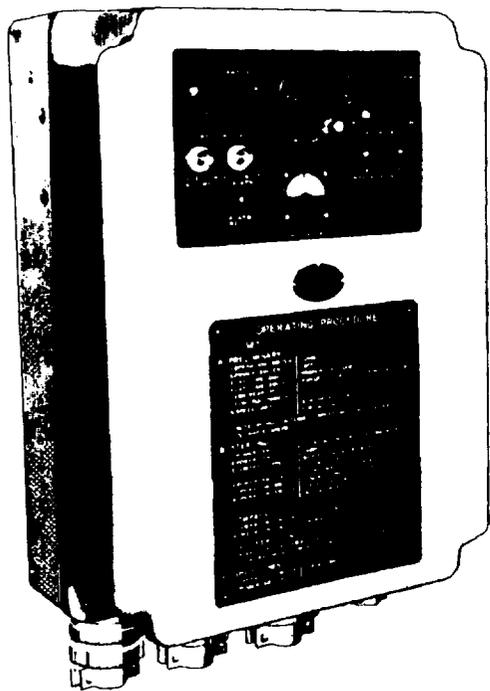
ALARM CONTROL



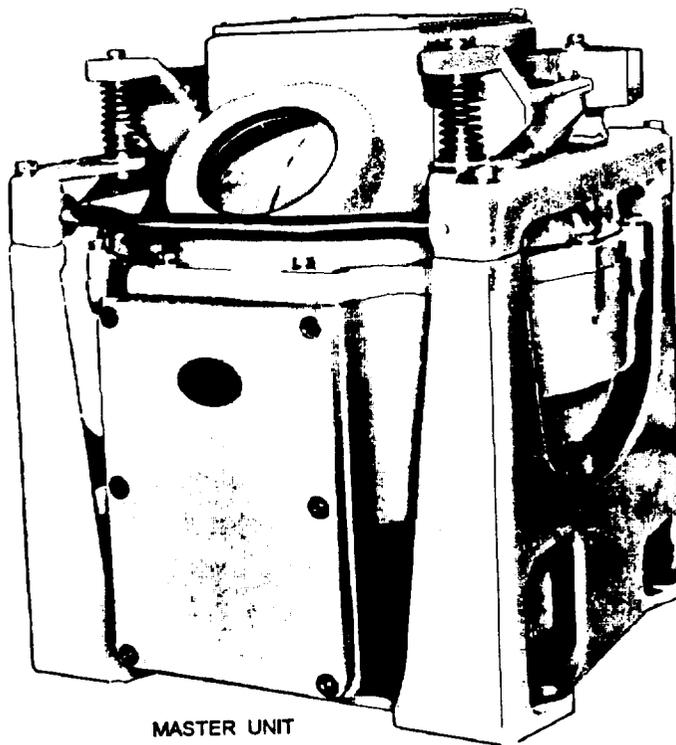
SPEED UNIT



COMPASS FAILURE
ANNUNCIATOR



CONTROL CABINET



MASTER UNIT

Figure 4-2.—Mk 23 Mod 0 gyrocompass equipment.

Mk 27 GYROCOMPASS SYSTEM

The Mk 27 gyrocompass is primarily a direct reading compass. This compass seeks and continuously indicates the bearing or true north. This gyrocompass consists of three major components: master unit, control cabinet, and power converter, as depicted in figure 4-3. Optional equipment includes a switching unit and a speed compensator. The Mk 27 gyrocompass can be configured to provide heading information to a remote area with a step transmitter, 1X or 36X synchro data transmitter, or a combination of these units.

AN/WSN-2 STABILIZED GYROCOMPASS SET

The AN/WSN-2 stabilized gyrocompass, shown in figure 4-4, seeks and continuously indicates the

meridian and zenith. The AN/WSN-2 provides precise output signals for ship's heading, roll, and pitch. The set uses an accelerometer-controlled, three-axis, gyro-stabilized platform to produce vital heading synchro data and reference, nonvital heading synchro data, and both roll and pitch angle synchro data. The AN/WSN-2 stabilized gyrocompass consists of five major components: inertial measuring unit, control indicator, control power supply, amplifier synchro signal, and battery set.

The AN/WSN-2 provides the following output signals: heading vital and nonvital (1X, 36X 400HZ synchro), roll and pitch (2X, 36X400 Hz synchro), and remote alarm.

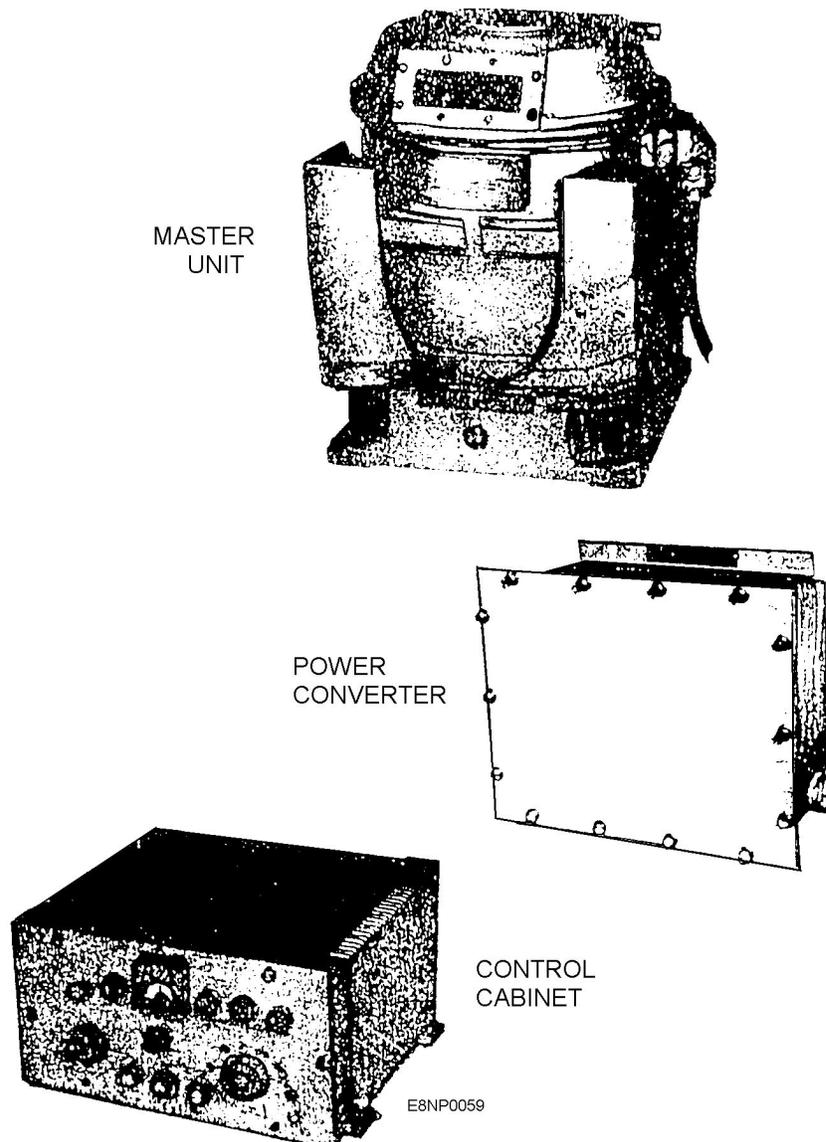


Figure 4-3.—Mk 27 Mod 0 gyrocompass equipment.

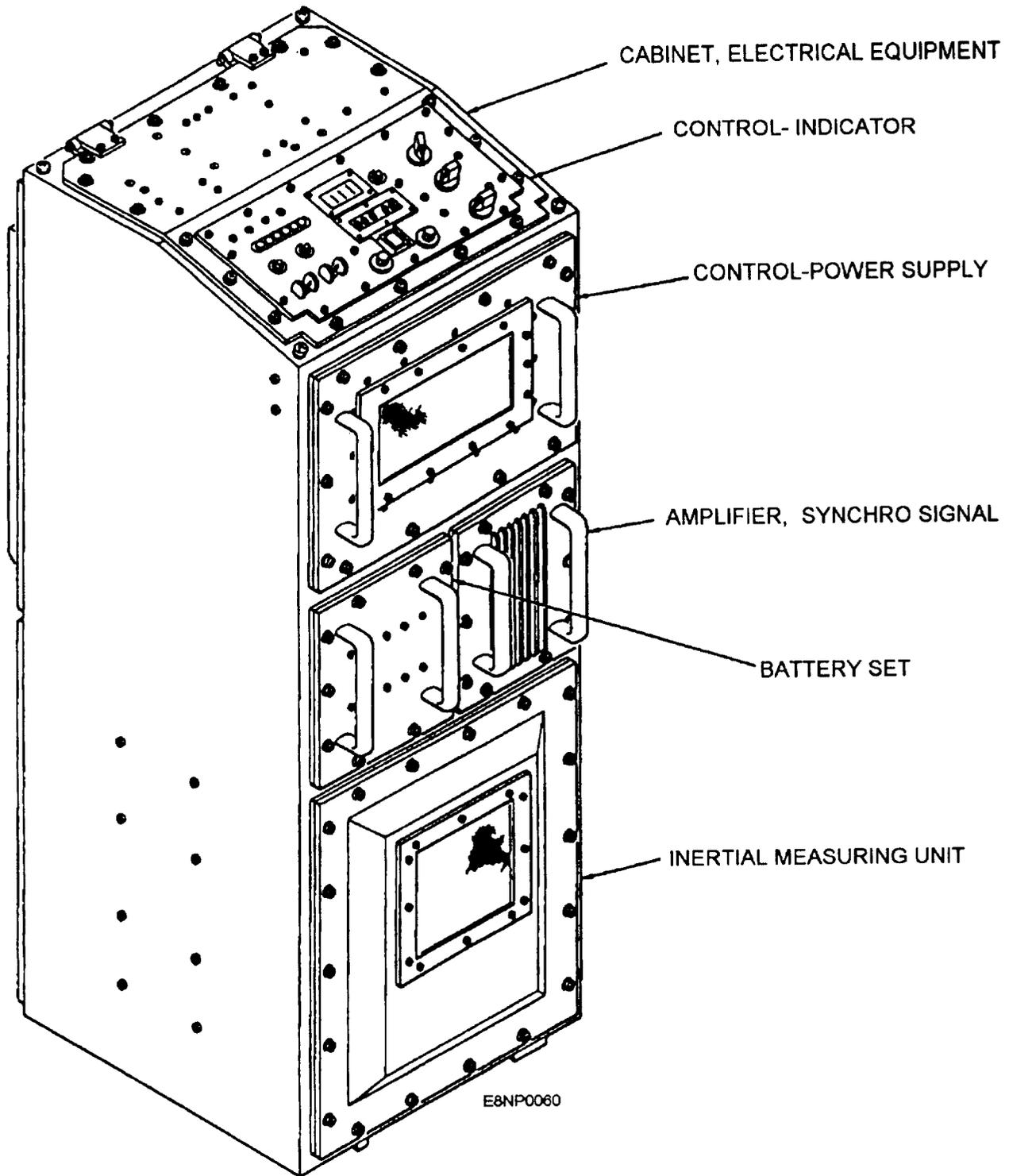


Figure 4-4. Stabilized Gyrocompass Set AN/WSN-2.

SYNCHRO SIGNAL AMPLIFIERS

Synchro signal amplifiers are installed where it is necessary to increase synchro load capacity, isolate synchro loads, or convert to a different synchro speed or output frequency. Generally, each radar system will

have its own synchro signal amplifier, and the Preventive Maintenance System (PMS) will usually assign responsibility for the amplifier to the work center that has responsibility for the system it directly feeds (i.e., SPS-55, SPS-49 will each have its own synchro signal amplifier.)

Figure 4-5 is an illustration of a synchro signal amplifier. Indicator lights for input and output excitation, servo follow-up, fuses, an alarm switch, and a dinner switch are mounted on the front of the amplifier. The indicator lights, when lighted, indicate that power is available and the servo system is operating. The 2-amp slow blow fuses are contained in indicators that light when a fuse blows. The alarm switch silences the audible alarm during an alarm condition. An audible alarm will sound for a loss of input or output excitation and for a servo follow-up error. The dimmer switch adjusts the brightness of the indicator lights. A heading dial is also mounted on the back of the panel with a window for viewing ship's heading.

AN/WSN-5 INERTIAL NAVIGATION SYSTEM

The AN/WSN-5 inertial navigation sets are installed on larger, newer ships—cruisers and earners. They continuously indicate the bearing and the zenith, thus serving as a reference for measuring the ship's roll, pitch, heading, and velocity north and east. The sets are a motion-sensing system that provides digital data (i.e., geographical position; horizontal and vertical velocity; attitude angle, and rate of heading, roll and pitch), and analog dual-speed synchro signals (i.e., heading, roll, pitch, velocity north and velocity east) for use by ownship equipment.

SYNCHRO SIGNAL CONVERTER

Synchro signal converters are used to increase the capacity of a synchro signal transmitter system, converting 60-HZ to 400-HZ synchro transmission, 400-Hz to 60-Hz synchro transmission, and converting relative bearing signals to true bearing signals. Additionally, they can convert to a different synchro speed or frequent y, and isolate reflected oscillations from the input synchro bus. Synchro signal amplifiers can be paralleled to increase load capacity.

Two ANWSN-5 sets are usually installed, one in the forward IC gyro room and one in the aft IC gyro room. Ship's position can be updated automatically by NAVSAT/NAVSTAR or manually from the keyboard. The operational program, which resides in the control power supply, performs the functions necessary to gather navigation and status data, compute position, velocity and attitude, and route the data. It processes this data into a suitable format, and transmits the formatted data to various combat systems users. Also the AN/WSN-5 operational program gathers AN/WRN-5A (V)2 reference data as an additional input for updating the AN/WRN-5 navigation data. The

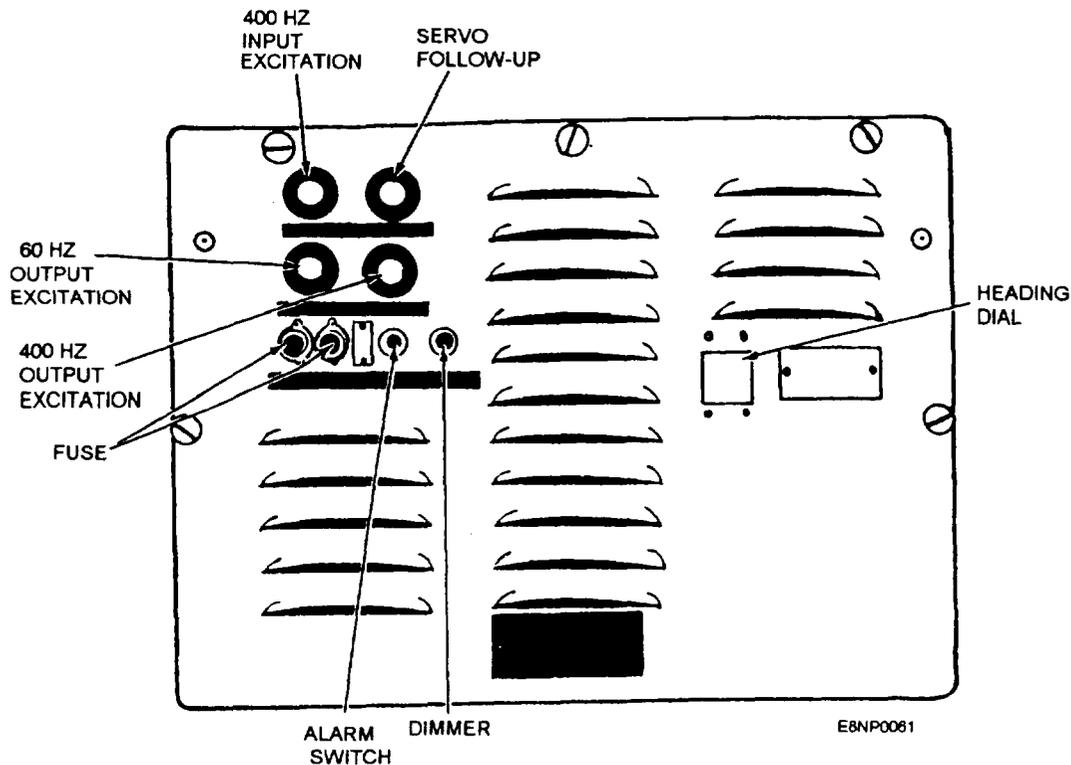


Figure 4-5. Synchro signal amplifier,

AN/WSN-5 consists of five major assemblies in an electrical cabinet:

- Control-indicator
- Control-power supply
- Battery set
- Synchro signal amplifier
- Inertial measuring unit

The AN/WSN-5 supplies the following output signals: heading (1X, 36X 400Hz), roll and pitch (2X, 36X 400 Hz), velocity north (1X, 10X 400Hz), and velocity east (1X, 10X 400HZ).

UNDERWATER LOG SYSTEM

The underwater log system measures and indicates the speed of the ship in knots and the distance traveled through the water in nautical miles. Two types of underwater log systems are currently available, electro-magnetic and Doppler. We will discuss the

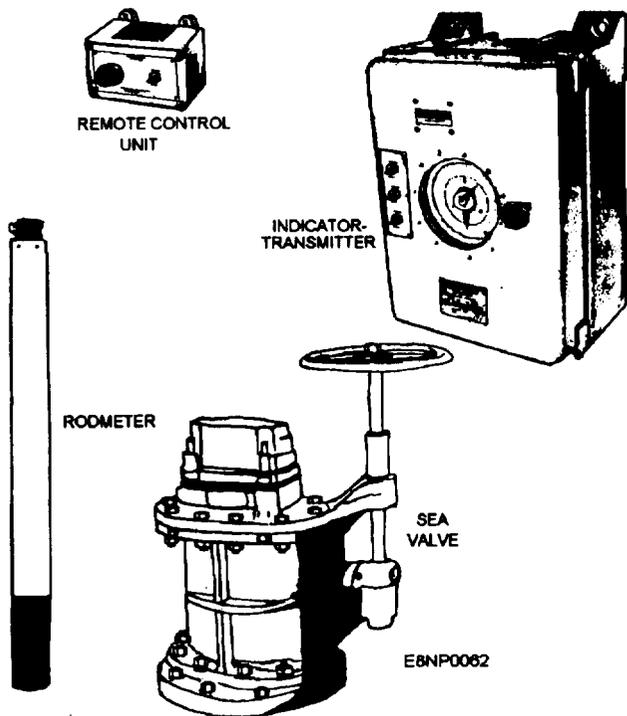


Figure 4-6.—Major components of the underwater log system.

electro-magnetic type in this chapter. The major components of this system, as depicted in figure 4-6, are the sea valve, rodmeter, indicator-transmitter, and remote control unit.

SEA VALVE

Mounted in the hull of the ship, the sea valve (fig. 4-7), and packing assembly provides a watertight support for the rodmeter. It also functions to seal the hull of the ship when the rodmeter is removed. The sea valve has no function relating to the production, transmission, flow, or conversion of data in the underwater log system.

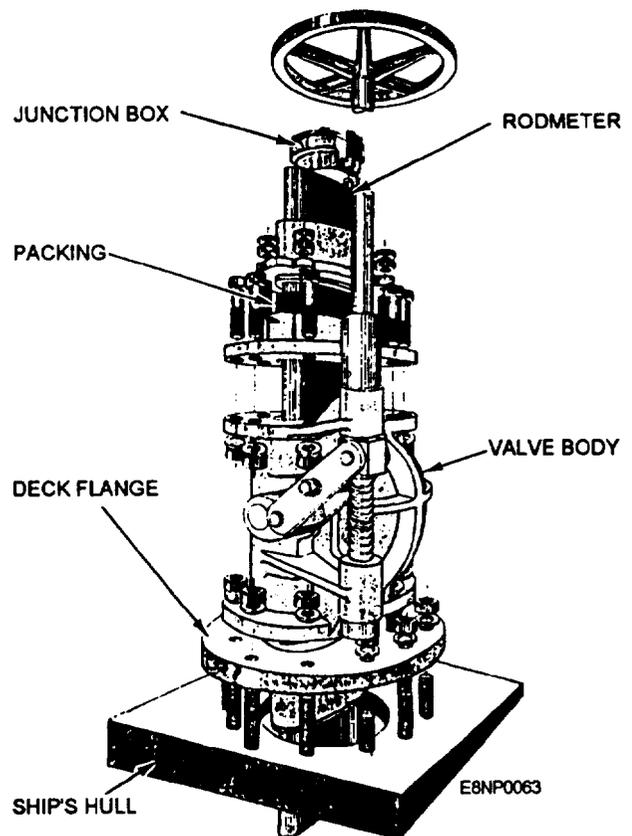


Figure 4-7.—Exploded view of these valve.

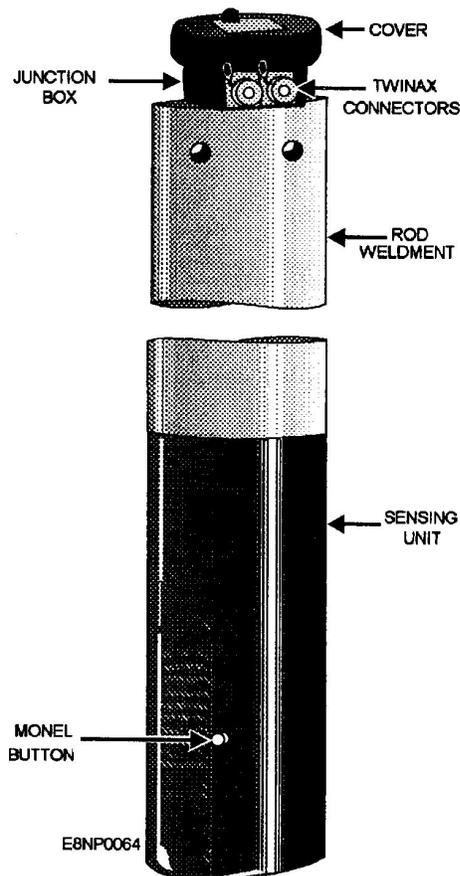


Figure 4-8.-Rodmeter.

RODMETER

The rodmeter (fig. 4-8), or sword as it is commonly called, provides an ac signal that is proportional to the ship's speed. The sensing unit (fig. 4-9) of the rodmeter is contained in a boot at its lower end. The rodmeter operates on the principle of electromagnetic induction, that is, when a conductor is made to move in a magnetic field so that it cuts through the lines of flux, an electromotive force (emf) is induced in the conductor. In the case of the rodmeter, a 60-HZ current is supplied to a coil in the boot of the rodmeter. As the current flows through the coil, a magnetic field is produced that surrounds the rodmeter. The water, the conductor in this instance, flows around the rodmeter and cuts through the magnetic field. The induced voltage is felt at the contacts, or buttons, on either side of the rodmeter.

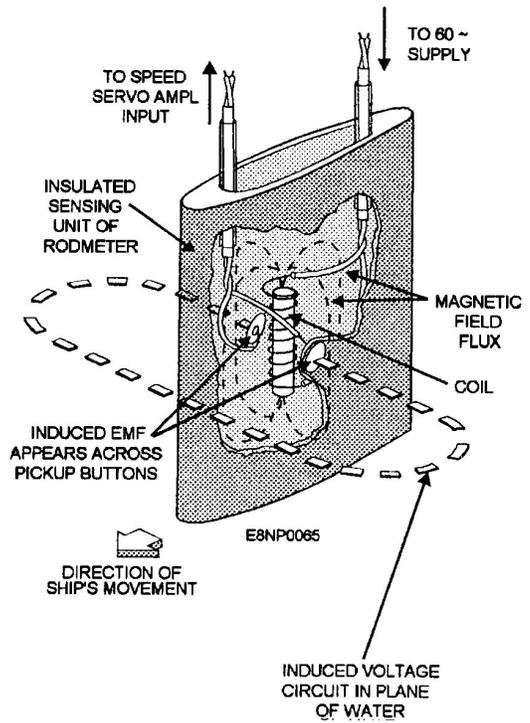


Figure 4-9.-Rodmeter sensing unit.

The magnitude of the induced voltage is proportional to the speed of the water flowing through the magnetic fields. Even when the ship is stationary, a current flowing around the rodmeter will cause a voltage to be induced.

INDICATOR-TRANSMITTER

The indicator-transmitter displays the ship's speed on a dial and the distance traveled on a counter and transmits the speed and distance information to various equipment and remote indicators throughout the ship.

REMOTE CONTROL UNIT

The remote control unit, or dummy log as it is commonly referred to, is used in place of the rodmeter when the ship is operating in shallow water, where lowering the rodmeter is impractical. The unit is normally located in the main propulsion control station. It has a spring-loaded, center-off, increase-decrease

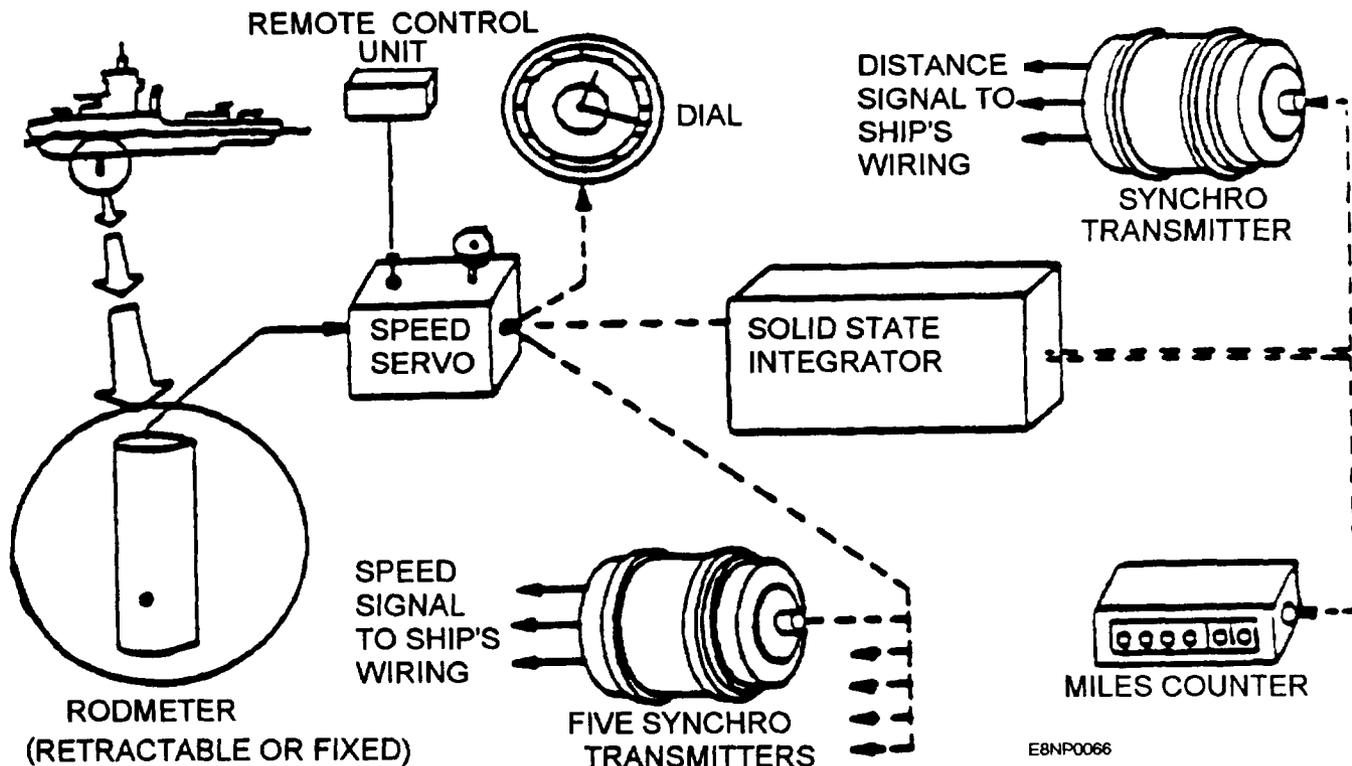


Figure 4-10.-Underwater log system.

switch and is operated by the throttleman. The shaft rpm is used to determine approximate ship's speed.

OUTPUT SIGNALS

The underwater log system (fig. 4-10) provides 60-Hz synchro signals scaled at 40 and 100 knots/revolution and 400-Hz signals scaled at 10, 40, and 100 knots/revolution. A resettable distance counter is provided on the front of the indicator-transmitter. Distance output is a 60-Hz synchro signal scaled at 360 revolutions per nautical mile.

SUMMARY

In this chapter, we introduced some of the most common gyrocompass systems—Mk 19, Mk 23, Mk 27, and AN/WSN-2. Additionally, we talked about the AN/WSN-5 inertial navigation system, electromagnetic underwater log system, and the data they Supply.

If a failure were to occur in one of these systems and introduce error to your equipment, you are now better able to isolate the faulty equipment and restore the overall system operability.

